

Brief Communication

ZINC CONCENTRATIONS IN PANCREAS AND LIVER OF
CATTLE IN NORWAY

Zinc, being an essential trace element, is supplied to cattle with the mineral mixture. Therefore, zinc deficiency in dairy cattle is hardly seen. The endogenous loss of zinc depends on the milk production, and also on the zinc level in milk. *Larssen* (1980) has shown that cattle with a moderate or low milk production may have a too low intake of zinc. He also showed that cattle with a high milk production have an average zinc supply of about 108 % of the required amount. This study thus seems to indicate a narrow margin between the actual zinc intake and the required amount. The average zinc level in Norwegian whole milk is 3.8 µg Zn/ml (*Gjøen & Norheim* unpublished results). This rather low zinc level seems to be in accordance with the results presented by *Larssen*.

A zinc deficiency causes only a moderate decline in the zinc level in some tissues, including liver and pancreas, with no change in others such as muscle and brain. Pancreas seems to be the organ where the zinc level fluctuates most according to the zinc intake (*Rosenberger* 1970, *Schwarz & Kirchgessner* 1975). The concentration of zinc in this organ might therefore reveal the zinc status of the animal. A minor deficiency might cause a small reduction in animal performance, but would be impossible to diagnose clinically. It might nevertheless have important economical implications (*Miller* 1969, 1970).

Fifty samples of bovine liver and pancreas were collected at a slaughterhouse in Oslo in February 1980. Half of the samples were from animals younger than 3 years, the other half from animals older than 3 years. The samples were digested with nitric and perchloric acid. After dilution zinc was determined by atomic absorption spectroscopy with the use of ordinary flame technique. The dry matter content was determined after drying of the samples overnight at 110°C. All samples were stored at -20°C before they were analysed.

The zinc concentrations in liver and pancreas from the two groups of cattle are shown in Table 1. For all the samples the average dry matter content was 28.9 ± 1.1 % for liver and

Table 1. The concentration of zinc in pancreas and liver ($\mu\text{g/g}$ wet weight) in two age groups of cattle.

Age	Number of samples	Pancreas mean \pm s (range)	Liver mean \pm s (range)
< 3 years	25	28 \pm 4 (18 — 36)	36 \pm 4 (26 — 43)
> 3 years	25	31 \pm 9 (20 — 51)	37 \pm 8 (24 — 51)
All ages	50	29 \pm 7 (18 — 51)	36 \pm 6 (24 — 51)

24.8 \pm 1.3 % for pancreas. In both groups of animals the zinc concentration in pancreas was lower than that in the liver. No significant difference was found between the two groups for any of the organs. There was no significant correlation between the zinc levels in liver and pancreas ($r < 0.37$).

The hepatic zinc levels found in the present investigation are in agreement with previous findings in cattle slaughtered in Norway (*Frøslie et al.* 1980). It was found that the hepatic zinc levels were essentially the same throughout the country. According to *Rosenberger* the normal zinc level in the liver of healthy calves is 125—170 $\mu\text{g/g}$ dry weight. This seems to indicate that about 50 % of the animals in the present investigation have a hepatic zinc level below the normal range, although zinc deficiency in cattle is not considered to be a problem in Norway (*Krogh pers. comm.*). *Rosenberger* also reported that the zinc level in pancreas in normal calves is 160—170 $\mu\text{g/g}$ dry weight and in calves with parakeratosis 60—70 $\mu\text{g/g}$. Based on this criterion only three of the tested animals had normal zinc levels and the rest belonged to an intermediate group.

Most analyses on zinc levels in pancreas have been made with samples from about 4 months old calves. However, *Neathery et al.* (1973) determined tissue levels of zinc in two groups of dairy cows receiving 16.6 and 39.5 $\mu\text{g Zn/g}$ fodder, respectively. Their results, together with the results obtained by *Ott et al.* (1966 a, b) on feeder cattle seem to indicate that the pancreatic zinc levels found in the present investigation correspond to an average daily intake of zinc in the cows investigated of about 50—55 $\mu\text{g/g}$ fodder, which is about the same as the requirement.

Further they indicate that the zinc levels in liver and pancreas calculated on a wet weight basis, should be about the same at a zinc intake of about 65—75 µg/g in the feed. Thus our study on tissue levels of zinc seems to be in agreement with the study done by *Larssen* on zinc levels in feedstuffs for dairy cows; the average daily intake of zinc seems to balance with the requirement.

Gunnar Norheim and Jostein Bjorland

The National Veterinary Institute and Oslo Board of Health, Oslo, Norway.

REFERENCES

- Frøslie, A., G. Norheim & E. Waasjø*: Copper, zinc and molybdenum in livers of Norwegian cattle at slaughter. *Acta vet. scand.* 1980, 21, 62—70.
- Larssen, R. B.*: Mineraltilførsel til melkekyr. Kalsium, fosfor, magnesium, sink, kobber og mangan i surfôr og kraftfôr. (Mineral supply to dairy cows. Calcium, phosphorous, magnesium, zinc, copper and manganese in ensilage and concentrates). Thesis, Oslo 1980, 56 pp.
- Miller, W. J.*: Absorption, tissue distribution, endogenous excretion, and homeostatic control of zinc in ruminants. *Amer. J. clin. Nutr.* 1969, 22, 1323—1331.
- Miller, W. J.*: Zinc nutrition in cattle: A review. *J. Dairy Sci.* 1970, 53, 1123—1135.
- Neathery, M. W., W. P. Miller, D. M. Blackmon, R. P. Gentry & J. B. Jones*: Absorption and tissue zinc content in lactating dairy cows as affected by low dietary zinc. *J. Animal Sci.* 1973, 37, 848—852.
- Ott, E. A., W. H. Smith, R. B. Harrington & W. M. Beeson*: Zinc toxicity in ruminants. II. Effect of high levels of dietary zinc on gains, feed consumption and feed efficiency of beef cattle. *J. Animal Sci.* 1966 a, 25, 419—423.
- Ott, E. A., W. H. Smith, R. B. Harrington, H. E. Parker & W. M. Beeson*: Zinc toxicity in ruminants. IV. Physiological changes in tissues of beef cattle. *J. Animal Sci.* 1966 b, 25, 432—438.
- Rosenberger, G.*: Krankheiten des Rindes. (Diseases of Cattle). Paul Parey, Berlin 1970, 1390 pp.
- Schwarz, W. A. & M. Kirchgessner*: Untersuchungen zum Zinkstatus und zur Dynamik des Zinks bei laktierende Kühen. Versuchsplanung und -durchführung. (Studies on the zinc status and the dynamics of zinc in lactating cows. Experimental design and procedures). *Z. Tierphysiol. Tierernährg. Futtermittelkde.* 1975, 34, 281—288.

(Received May 5, 1981).

Reprints may be requested from: Gunnar Norheim, the National Veterinary Institute, P.O. Box 8156, Dep., Oslo 1, Norway.